

LETTER

ADDRESSED

TO SIR JOHN SINCLAIR BART.

PRESIDENT OF THE BOARD OF AGRICULTURE AND
INTERNAL IMPROVEMENT.

RESPECTING THE IMPORTANT DISCOVERY LATELY MADE IN SWEDEN, OF
A METHOD TO EXTINGUISH FIRE, WITH AN ACCOUNT OF THE PROCESS
ADOPTED FOR THAT PURPOSE; AND HINTS OF MEANS FOR PRESERVING
TIMBER USED EITHER IN HOUSES, OR IN SHIP BUILDING, FROM THAT
DESTRUCTIVE ELEMENT.

BY MR WILLIAM KNOX,
MERCHANT IN GOTHENBURG.

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A D V E R T I S E M E N T:

THE translator of the following paper can, with great justice, say, that the original treatise in the Swedish language has been but very few days in his possession, and that he has since laboured with unremitting diligence, to translate it into English, in order to convey the earliest intelligence of so important a discovery to his countrymen. He hopes therefore he will be excused for any grammatical errors; as he has been more attentive to give an exact description of the different solutions for extinguishing fire, than to fine language.

It strikes the translator, there are two articles to be obtained in Britain for extinguishing fire, which are not mentioned in the original treatise, but which he thinks may be useful, and are to be procured at a low price. These are kelp and pulverized chalk, by which he thinks the number of the compound solutions may be increased,

Kelp appears proper, for this reason, that it contains a compound of the alkaline and marine, or common sea salt, and possesses this advantage, that it comes infinitely cheaper than wood or any foreign ashes.

Chalk also is very cheap in England, and may be substituted when pulverized, in place of lime or pounded clay, for forming the compound or the more viscid solutions.

The translator has no doubt that from the industry of the English nation, they will immediately carry this system for extinguishing fire to all the perfection of which it is capable, and that the different fire offices will take an early opportunity of instituting a train of experiments in order practically to satisfy themselves, of the utility of this discovery, as well as to ascertain the nature and efficacy of the different simple and compound solutions herein after specified.

LETTER

TO SIR JOHN SINCLAIR &c.

SIR,

I KNOW no person to whom I can with greater propriety transmit the following translation of a late interesting Swedish publication, than to you; a gentleman, who, in a praise worthy manner, is at all times so zealous and active, in promoting whatever tends to the improvement and prosperity of your native country.

It is not long ago, since I had the honour to present you with a drawing, representing the method of shocking corn in the open field, so as to be defended against the effects of bad weather, in the worst of harvests: and if when housed, we can point out to the farmer a way, whereby he can in some measure secure his property against the ravages of fire, you will certainly allow, that two very material points are gained to the public.

The method of extinguishing fire described in the following treatise, is so simple and effectual, and the materials requisite, so much within every man's reach, that I am persua-

ded if gentlemen, farmers, and the public at large, were only to provide themselves with, and have always at hand, *such ingredients calculated for the purpose, as they can most easily obtain in their different situations*, much property, which often becomes a prey to the flames, might be preserved from destruction. I think it is about two or three years, since the first intelligence of this discovery was given by a Mr Von Aken of Orebro, and I remember then of reading in the Stockholm papers, that the engines used were so very cheap and simple, that every person could procure such at a trifling expence.

Mr Von Aken, on the 27 Oct. 1792, had an exhibition at Stockholm, to shew the efficacy of his fire-extinguishing solutions, of which I herewith send you the drawing and description: And I have every reason to believe, that Mr Nystrom's materials for the extinction of fire, are of the same nature, at least are equally effectual.

I hope this method of extinguishing fire, may, by God's blessing, be the means of saving the lives and properties of mankind: a circumstance which will afford the translator infinite satisfaction, tho' he claims no other merit, than being perhaps the first, who has given a particular account, of so useful a discovery, to his countrymen.

A TREATISE on the constituent principles of various
SIMPLE and COMPOUND SOLUTIONS for EXTINGUISHING of FIRE: sent to the ROYAL SOCIETY
of ARTS and SCIENCES at STOCKHOLM, 13. Dec.
1792. By NILS NYSTROM, Apothecary in Norrkoping.

Translated from the original Swedish, 13. Nov. 1793.

A LATE fire which happened in the town of Norrkoping, was the immediate occasion of my renewing certain experiments, in regard to various solutions which may be used for extinguishing fire. It is several years ago since I began to think of such preparations, and I made at that time several experiments on a small scale. But having heard, that Mr Assessor Von Aken, had, in a praise worthy manner, taken the matter up, I thought it unnecessary for me to prosecute them farther, more especially as it appeared, by many repeated experiments on a large scale, that he had given the public full evidence of the certainty of his discovery. Nevertheless, as that fortunate and important invention, has not been communicated to the public; but one town has been allowed to burn down after another with a careless indifference: I have been led to believe, that the experiments I

have made, may be of use to mankind in general. It is with that well meant intention, therefore, that I hereby communicate to the Royal Society of Arts and Sciences at Stockholm, the result of all my discoveries and experiments; as well as submit them to the future and mature investigation of that learned body of men.

As almost all incombustible materials which can be dissolved in, and mixed with water, are serviceable for the purpose of extinguishing fire; hence the idea naturally occurred to me, of trying experiments for that purpose, with such as are least costly, and can be obtained in every situation:----And I have found buildings naturally susceptible of fire, if fortified with solutions made from such incombustible ingredients, to resist its depredations: Farther, when the water thrown by engines is mixed with such a solution, I have known it to extinguish fires, which broke out in buildings, of the most combustible nature.

Of such solutions, the following are the proportions, to mix with the water, which is thrown from engines, for the extinction of fires.

I. *The simple solutions are,*

1. 12 Kans of the strongest solution of wood ashes, to 100 kans water.
2. 8 Kans of the finest beat pot ashes, to 100 kans water.
3. 10 Kans of well dried and fine beat kitchen or common salt, to 100 kans water.
4. 10 Kans of well dried and fine beat green vitriol or copperas, to 100 kans water.
5. 15 Kans of the strongest herring pickle, to 100 kans of water.
6. 12 Kans of fine beat alum, to 100 kans of water.
7. 20 Kans of well dried, fine beat, and well sifted clay, to 100 kans water.

II. *The compound solutions are.*

1. 10 Kans of a compound of clay, vitriol, and common salt, say 3½ kans of each, to 100 kans of water.
2. 12 Kans of the strongest solution of wood ashes, and fine clay reduced to a powder, say 6 kans of each, to 100 kans water.
3. 10 Kans of a compound of red ochre, or the residuum of aqua fortis, and common salt, say 5 kans of each, to 100 kans water.
4. 10 Kans of a compound of the strongest herring pickle, and red ochre, or the residuum of aqua fortis, say 5 kans of each, to 100 kans water.

General remarks.

THE clay and salts, ought to be well dried, so that they can be reduced to a fine powder, and in this manner, be immediately mixed with cold water, so as to be dissolved therein. Because to have such solutions continually at hand dissolved in water, requires both very large and tight vessels or reservoirs; which are apt, in length of time, to fail; by which means the solutions are lost.

All these solutions in the above proportions, are equally efficacious for the extinction of fire: nevertheless we are of opinion that the compounds are the surest and most powerful for that purpose.

The efficacy of the solutions prepared as above mentioned, for the extinction of fire, have been proved in the following manner.

1. If they are mixed with water in the different proportions above stated, and if materials of the most combustible nature are set on fire; such as burning coal, resin, hemp, or tow, chips or deal shavings, oil of turpentine &c. &c. I have found by many repeated experiments, that such solutions mixed with

water in the foregoing proportions, thrown only by a hand engine, are sufficiently powerful to extinguish fires of the most inflammable nature.

2. In order to be satisfied that materials of the most combustible quality, could be prepared and fortified so as, without the intervention of water, to resist the effects of fire, and not be permitted to kindle ; I made the following experiment. I dissolved in boiling water some of my anticomustible ingredients, and made the solution as strong as it was possible to impregnate the water with ; I then laid in this solution a piece of burning charcoal, which after allowing to remain therein a few minutes, I took out and dried properly ; afterwards I exposed it to the effect of a flame thrown by means of a blow pipe upon it, and I even allowed this flame to act until I fused therein a piece of bismuth : But strong as the flame was, it had not the smallest effect in rekindling the coal ; and when I gave over blowing, the small glowing point I had by constant blowing, impressed or indented in the coal, became instantly invisible.

3. I laid cartridge paper in this solution, which after being dried, I found impossible again to set fire to, even tho' held in the flames.

4. I melted resin, and mixed therewith equal proportions of pulverized incombustible ingredients, which I afterwards exposed to the

flames: but found this composition very backward in taking fire, and that when removed from the flame, any fire therein immediately became extinct.

Observations.

Water alone is in some measure an element which possesses the property of extinguishing fire: but as this element is not altogether fire proof, so water is very soon dissipated by the violent action of fire, and converted into smoke or steam.

Hence the great necessity of such ingredients being mixed with it as are found capable of resisting fire: Because these not only pierce through and shut the fire brand pores, but even exclude the action, and obstruct the circulation of the air, and in this manner not only extinguish fire, but also prevent its re-kindling or breaking out afresh.

If any one, as occasion requires, finds it needful, to increase or diminish the strength of the above described fire-extinguishing ingredients, the spouting therewith from the water engine, can be managed equally well, and the solution be made of whatever proportional strength is most agreeable; namely, so strong as equal parts: that is to say, one kan of the anticomustible solution, to one kan of

water, which mixture can without any obstacle or inconvenience, be thrown out by the fire engine. Further, such solutions can be mixed with the pulverized ingredients, before and after mentioned, and experiments with such mixtures tried.

Again, should any one find that the powdered ingredients clot, or clod, when mixed with too great a quantity of water ; this inconvenience can be easily removed by mixing them in a separate vessel ; first, only with so small a quantity of water, as to bring the whole mass to the consistence of paste ; after which, by gradually adding more water, one may dilute, and reduce this mass to a proper consistence or thinness, so as to pass through the engine and leather pipes, and that without any danger of choaking or obstructing the action of either

As contrary opinions often prevent the best and most praise worthy objects, from being reduced to practice, and rendered really useful to society : I beg leave to make the following remarks on a paper couched in very decent and becoming language, sent from Garphyttan and inserted in the Stockholm extra post, No. 69.----The paper alluded to re-

fers to a memorial delivered to the Royal Society of Stockholm, by the late director Meyers, Anno 1754, wherein Mr Meyers states some difficulties with regard to the fire-extinguishing ingredients then proposed to be used, and the impossibility of preserving them &c. &c.

The following remarks may therefore be considered as answers to these objections.

1. All salts can be prevented from chrysalization, when they are dissolved in as much water, as not to shoot out chrystals, in a cold room; after which they may be preserved in tight casks to prevent evaporation: But as there is a greater number of casks required for this purpose, than for the pulverized ingredients, and as perhaps strong frosts may have the effect to burst the containing vessels, whereby both the casks, and their contents are lost. So I consider this method of preservation, only applicable to herring pickle, or the solution of wood ashes, which fact I have ascertained by experience.

2. What regards another objection, that the pulverized materials, particularly salts, cannot be preserved any time in casks without attracting dampness, and running into clots; I have to answer,---That this objection has very little weight, when it is considered, that such clottiness is only found at

the sides and bottoms of the casks, and when the salts are previously mixed with certain kinds of clays or earths, any strong concretion is prevented; besides, such concretions are of little or no consequence, when it is considered, that these clots can be dried, and beat asunder, so as readily to mix with, and dissolve in water; and in order fully to repel this objection, I would recommend the use of such middle, mean, or mineral salts, as do not attract dampness, after they are properly dried and powdered. And these are :

1. Alum.

2. All our three common sorts of vitriol, such as zink, copper, and iron vitriol; and if this last, which is least costly in point of expence, be dried with a gentle, not a strong fire, and afterwards be only reduced to a fine powder, then I am certain it will not farther attract any dampness.

3. The residuum arising from the manufacture of aquafortis, which consists of a kind of red ochre:---And the component parts thereof consist of an alkaline, vegetable, vitriolated, calcined, iron, and are of the same use in extinguishing fire as iron vitriol, or any other mineral salt mixed with earthy matters. I have further to observe, that all

residuum similar to such as we have described under this article, can be preserved under cover in the open air in a dry form, and these also admit of being reduced to a powder without any previous drying.

Amongst the mineral or middle salts, with which I have had occasion to try experiments for the purposes in question, I have found that our common kitchen salt, is the only one that retains moisture, and even after being dried and pulverized again, re-attracts that moisture from the atmosphere; but this inconvenience can be remedied, if such salt is mixed with dry powdered clay; and in regard to what relates to the crumbling down of salt, or salts, in a warm atmosphere, falling down to a fine powder, I have only to observe, that by this means, they become more fit and useful, as well as remain in a state of the best preservation for the purpose intended.

The end proposed to be obtained by the mixing of clay, is two fold.

1. To prevent the connection of the pulverized salts.
2. To quench fire more readily by spouting with such clayey solutions, as thereby the access or further action of the circumambient air, which every one knows is the feeder of flame, is more effectually prevented.

3. In regard to the expence of the materials necessary for the extinction of fire, (a consideration of the highest importance to the public in general, and to the poor in particular,) I cannot point out any ingredients, more economical or less costly, than a strong solution made from wood ashes mixed with pulverised clay, for the obtaining of which, at least in Sweden, little more is necessary, than the expence of collecting the materials. I would next recommend herring brine, mixed with red ochre, or the residuum of aquafortis. The first of which, is to be bought every where in Sweden, at from one shilling and four pence, to two shillings sterling, per barrel; and the last, at eight shillings the ship-pound.

Herring pickle, though it contains some oily and inflammable matter, is nevertheless nearly of the same use, as a solution of common kitchen salt, and is obtained every where at a far inferior price.

Even lime in place of clay, mixed with salts, can be servicable for the purposes above mentioned. But I have, in particular rather made use of clay, because that is most susceptible of being mixed with water, and is most readily obtained, almost in every situation. Lime, also, possesses this peculiar quality, that, if mixed with certain neutral, or

middle salts, more especially with common sea salt, it becomes deliquescent, which inconvenience however can be obviated by mixing it with pulverized clay.

As there is some reason to apprehend, that the fire engine, and the leather pipes connected therewith, may be choaked by these kinds of viscid solutions;----I have much pleasure in asserting, from the repeated experiments I have made, that all risk of this inconvenience is removed, if a proper diluted solution of pulverized clay, is used along with the other salts.

But on every occasion, the leather pipes must be well rinsed with clean water, to prevent such obstructions.

From what I have already stated, I hope it will appear, that the cost of the ingredients necessary for extinguishing fire, will prove very inconsiderable, compared to the advantages that are to be derived therefrom.

When large quantities of such ingredients are wanted, it may be necessary to grind and prepare them in a miln.---In smaller quantities, they may be beat in a morter, and passed through a hair sieve.

In towns, it may be most convenient, to use a mixture of clay, vitriol, and salt; or only of clay and salt, otherwise a mixture of herring pickle, and red ochre, or the residuum of aquafortis;----But in the

country, I would recommend pulverized clay, diluted in a strong solution of wood ashes, or pulverized clay, diluted in herring pickle. However, of these unmixed ingredients, every one can chuse after his own pleasure.

Herring pickle, and the solution of wood ashes, must not be mixed with pulverized clay, until they are immediately to be used, and therefore must be preserved in separate vessels.

The difference between the power and effect, of the several fire-extinguishing ingredients, is very inconsiderable: the great point lies in the proper preparation and dilution thereof, and whether one chuses to have the solutions weaker or stronger. And this has induced me to try the several different materials above recited, in order that every one, as occasion requires, may have recourse to those, which *in his particular situation*, are nearest at hand, *and most speedily obtained*.

It were much to be wished, that any one could discover, better or more simple ingredients, for extinguishing fire, than those mentioned in this treatise: *but as all uninflammable bodies which can be dissolved in water*, are the only ones which are likely to be useful for this purpose: so in my opinion, there is little hope, of any more servicable means of extinguishing fire being invented.

(Signed,) Nils Nystrom.

The above treatise, as well as proofs or samples of the fire-extinguishing ingredients above recited, were sent to the Royal Society of Stockholm, under a sealed cover, on the 13th Dec. 1792: but were not allowed to be opened, till the 1st of June following; and in fact were not examined, before the 19 June 1793.

The above is a literal translation of the paper, sent by Mr Nystrom of Norrkoping, to the Royal Society of Stockholm. But he has since added an Appendix, containing directions for the preparation of several additional mixtures*, for the extinction of fire; also the result of several successful experiments, by which he convinced his countrymen, of the efficacy of his fire-extinguishing solutions.

* In many parts of Great Britain the cheapest solution that could be obtained, is, what is called *bittern*, a strong solution of magnesia, and glaubers salt, obtained in making common salt. This, as it is obtained, is a fully saturated solution. Were prepared clay to be mixed with this solution, till it assumed the consistence of thick honey, it might then be kept in casks ready for use, and could be easily diluted in a sufficient degree, by an addition of fresh *bittern* when to be used.

APPENDIX.

Containing some additional directions, with regard to preparing solutions for extinguishing fire ; also, the result of two experiments made therewith at Norrköping, the 30 Sept. and 16 Oct. 1793 ; in presence of some of the principal persons of that town and neighbourhood.

HAVING, with a fire engine, and leather pipe appended thereto, made several additional experiments, I found that the solutions could be thrown with equal force, and to the desired height, and though compounded of thicker mixtures, that their power was not thereby in any respect impeded. On the contrary, the thicker such mixtures were made, the greater efficacy they had in extinguishing fire. I also found, that strong windy weather, operates less on such streams as are compounded of the thicker solutions, than on simple water, when thrown from fire engines, owing to the greater weight of the compounded solutions. When one begins therefore to check the ra-

vages of fire, I advise the use of the thicker solutions until the violence of the flames are repressed or extinguished, whereas in regard to the corners and smaller openings of the house (as the extinction of the fire cannot be carried into immediate execution) I would advise to continue the use of the thinner solutions, or even water alone: In this way two objects are gained, namely the most violent and dangerous part of the fire is almost instantly damped, and the fire extinguishing ingredients, are not expended in an unnecessary manner.

The following proportions, I have found to be the most useful, for the thicker mixtures: They ought to be brought to the consistence of a thin gruel, after which they can be diluted and made thinner by an addition of water, if that is found necessary.

1. 30 Kans of a mixture of pulverized clay, vitriol, and salt, to 15 kans of water.

2. 15 Kans of red paint, or the residuum of aquafortis, and 15 kans of herring or salt pickle, to 7½ kans of water.

3. To clay and a solution of wood ashes, add only as much water as to bring the whole mass to the consistence of a thin gruel.

4. 30 Kans slack'd gray or white lime, to 20 kans strong herring pickle; the lime must be passed through a hair sieve, to prevent a-

ny mixture of small stones or clots, and the herring pickle must be strained, so as to free it from undissolved salt and herring scales, which might otherwise choak the pipes of the engine.

All these mixtures must be well stirred round, so that the fire-extinguishing ingredients do not fall to the bottom of the containing vessels.

As I have found that dissolved kitchen salt has a stronger effect in the extinction of fire, than the same salt finely pulverized and mixed with clay, as above directed, and as I have found that the strongest solutions thereof, do not shoot out chryſtals in cold weather, when preserved in tight vessels, which also prevent evaporation, so I have no hesitation in affirming, that a solution of salt in water, has twice the efficacy of pulverized salts.---- This salt pickle, must be made with boiling water, as strong as it is possible to impregnate that water with; *care* however must be taken, not to use more salt, than the water is capable of saturating, for it would be improper, that any undissolved salt, should remain at the bottom of the vessel.

The following preparations were ordered, and an actual trial made with the fire-extinguishing materials above mentioned, by Mr. Ny-
strom, apothecary in Norrkoping.

ON the 30th of September 1793, at 3 o'clock in the afternoon, a house was built a little without the north gate of the town of Norrkoping, and being properly surveyed and examined, was found to be of the following description. This house was built of old and well dried timber, the size, 10 feet square, and was covered in with a roof of dry deals ; two doors and windows on each side of this building were so placed that the air had free access. It was well tarred in the inside, as well as on the out. It was filled up to the roof with dry faggots, tar barrels, and resin, and was even inclosed with bunches of faggots set up on all sides. The kindling of the fire, took place at all the four openings, at once, and in a few minutes the whole building was completely on fire, and it evidently appeared, that the flames had reached their greatest height.

The process for extinguishing this fire, was begun with a small fire engine, much about the same size with that which Mr Von Aken had used for his experiments, and the extinction of this fire, was fully effected, in the space of six minutes, if we except some inconsiderable fire, which appeared remaining in the crevices and corners of the building, as well as amongst the faggots, which was afterwards quenched with water.---About 28

kans of the fire extinguishing ingredients were used for this experiment.

Afterwards another trial was made with six tar barrels, which were set in full blaze, and this fire was extinguished with such alertness, by two other particular mixtures, that no sooner did the solutions reach these tar barrels, than the extinction of the fire was at once completely effected.

The undersubscribing was present at the extinguishing of the fire in the above described house, and the events stated in this paper I hereby certify to be strictly consistent with truth, *ut supra.*

(Signed,) AND. P. IGGELSTROM.

We do hereby certify that we were present, on the occasion of extinguishing the fire above described. That we surveyed the combustible materials set on fire, and examined very narrowly into all the circumstances narrated in this paper, as well as witnessed the final event as above described. Having found the same strictly just, we therefore hereby certify the truth thereof.

JEREMIA MOBERG
Preses of the corporation of Merchants. } } ANDERS BILLSTON
Preses of the corporation of tradesmen & handi-crafts.

Norrkoping 3 Oct 1793.

D

Copy of another attestation.

Whereas Mr Nils Nystrom apothecary, caused insert in the Norrkoping paper, that on the day undermentioned, he proposed to try the efficacy of his new discovered fire-extinguishing ingredients, on the common called Sylton, belonging to the town of Norrkoping.

There appeared therefore the following noblemen, as well as a number of persons of rank, and other inhabitants of the town, to witness this experiment ; namely,

The Right Honourable his Excellency baron C. A. Wachtmeister, Lieutenant Colonel Marshal, and knight of the Order of the Sword and Great Crofs.

The Right Honourable Baron T. G. Stromfeldt, Governor of the province, Rear Admiral, and commander of the Order of the Sword and Great Crofs.

The Honourable Sir N. F. Jernfeldtz, Lieutenant Colonel in his majesty's service ; besides a number of people of rank, as well as inhabitants of the town of Norrkoping.

The previous preparations made for this experiment were of the following nature. A house 16 feet square was raised of well seasoned and dry timber ; the height of the walls under the roof was ten feet ; the elevation of the roof five feet perpendicular ; and the doors and windows of this building were so placed,

one opposite to another, that the air had free access. It was tarred all over, both inside and out, and filled with faggots and tar barrels; moreover the outside of this house was covered with bunches of tarred faggots. The building thus erected was set on fire, under a violent storm of wind, by which means the power of the flames was doubled, and had acquired much additional strength, at which period, the extinction of the fire was begun with a small engine, whose leather pipe was only one fourth of an inch in diameter, which nevertheless produced such an effect, that the fire-extinguishing solution no sooner reached the house, than the force of the fire was immediately diminished. The engine, during this operation broke, and had to be repaired, which occasioned a delay of 4 minutes, for which reason the complete extinction of the fire was not effected until the expiry of 14 minutes; but if we deduct the 4 minutes lost, the time taken in extinguishing this fire was really no more than 10 minutes.

The solution used on this occasion consisted of 15 kans herring pickle, 15 kans red ochre, or the residuum of aquafortis.

To which were added only $7\frac{1}{2}$ kans of water; and of this solution about 60 kans were expended. Afterwards fire was set to 18 barrels tarred both without and within, which,

in the same way as the house, burned with the greatest violence ; notwithstanding which, the extinction thereof was carried into execution, with a solution consisting of 1 part herring pickle, to $1\frac{1}{2}$ part gray lime, without the addition of any water.

And this solution proved so powerful, that the fire of the 18 tarred barrels, was extinguished in the space of about half a minute of time. And that all these transactions as above recited, really, and truly, passed in our presence, we hereby certify,

Norrkoping 16th of October 1793.

(Signed,) C. A. Wachtmeister.
T. G. Stromfeldt.
N. F. Jernfeldtz, &c. &c.

I hereby certify, that the above copy, is of the same import, and exactly corresponds with the original paper.

(Signed,) *Adolph Becker,*
Notary to the town of Norrkoping.

*General remarks, respecting the experiments made
on the 30th. September 1793.*

THE fire in the house was extinguished by the mixture marked No.1 in the appendix. That of one half of the tarred barrels, set fire to

same day, was extinguished by mixture No. 2, and the fire of the other half, by mixture No. 3. In the experiment made the 10th October, the fire in the house was extinguished by mixture No. 3. and that of the tarred barrels, by mixture No. 4.

N. B. All these, refer to the numbers of the solutions and mixtures, marked in the appendix.

I consider the solutions of the following ingredients, to be the most serviceable and most certain, not only to fortify wooden houses against fire, but also to preserve them from rottenness or decay.

1. Equal parts of common kitchen salt and green vitriol. 2. Equal parts of common kitchen salt, and red ochre, or the residuum of aquafortis; of these mixtures or ingredients, it is necessary to make strong solutions with boiling water, nay so strong, that it is possible to lay, or daub the walls of wooden houses with them. During this operation however, one must use a red hot stone, or brick, and therewith constantly rub the solution into the pores of the wood, in order that it may form a crust on the outside, which will not dissolve for a long time, nor be washed off by rain, or bad weather, but resist the effects and power both of fire and water.

If these ingredients were mixed with a little red paint, one may, in a lasting manner, paint houses red, at one and the same time.

Alum is also very serviceable for this purpose, but the price of that article, is in general much too dear.

(Signed,) *Nils Nystrom.*

Norrkoping the 21st of October, 1793.

HINTS FOR THE NAVY.

THE mode above described, of preserving timber for building, is of much greater importance, if applicable to timber for ship building, in particular for the navy, which it is believed is the case. The system not being yet brought to perfection, it is sufficient, at present, to throw out this hint, for farther investigation and experiment. If found to answer, it will be a circumstance of essential importance indeed to the navy of Great Britain.

CONCLUSION.

The following calculations will explain to the English reader, the weight and measures mentioned in the above papers.

1. The Swedish ship-pound for all the merchandize sold by weight in Sweden, (Iron

excepted), is exactly equal to $3\frac{1}{2}$ cwt. avoirdupois, that is to say, 6 ship-pound of such weight makes 20 Cwt. English.

2. 1 Swedish kan is equal to 3 English quarts, or $1\frac{1}{2}$ Scotch pints. Again, 90 Swedish kans, are exactly equal to 54 gallons English, beer measure, or equal to the size of a common porter hogshead; consequently, 60 Swedish kans are equal to 36 beer gallons, or what is called the proper beer barrel.

3. The Swedish herring barrel is fully equal to, or rather more, than 32 English gallons, being larger than the English herring barrel.

EXPLANATION OF THE PLATE.

EXTINCTION of fire, effected in the presence of his majesty the king of Sweden, as well as in the presence of his royal highness the duke of Sudermanland, regent of that kingdom.

On this occasion all the higher and lower statesmen, as well as foreign ministers, were present, and the chief people in Stockholm. This experiment was made at the Haga, Oct. 27. 1792. by Mr T. V. Aken, with the fire-extinguishing solutions he had invented.

Description of the Building set fire to.

THE boat which appears in this drawing was 24 feet long, 7 feet broad, $2\frac{1}{2}$ feet deep. The place which the tar barrels surrounded was 40 feet long, and 36 feet broad. The 100 tar barrels were placed in three rows, one above another, so as to form a septagon. Over the boat there was a cover, composed of six dozen of deals. And the area of the building

might be about 1800 square feet. This building was also payed or covered over with four barrels of tar, ten lb. of turpentine, and three quarts of the oil of turpentine. The bottoms of the tar casks were taken out, and these filled with birch bark and straw. A pot too, placed in the boat, was filled with 24 quarts of pitch.

Thereafter, all these combustible materials were set fire to, and allowed to burn for the space of five minutes; but were extinguished in four minutes, by three persons only. The fire engine was so small, that a child could almost draw it. The quantity of the fire-extinguishing solution expended, was 72 Swedish kans, equal to 216 English quarts.

THE END.



